

# **Application of SAS®!**

## **Enterprise Miner™ in Credit Risk Analytics**

Presented by

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# Credit Risk Analysis Overview

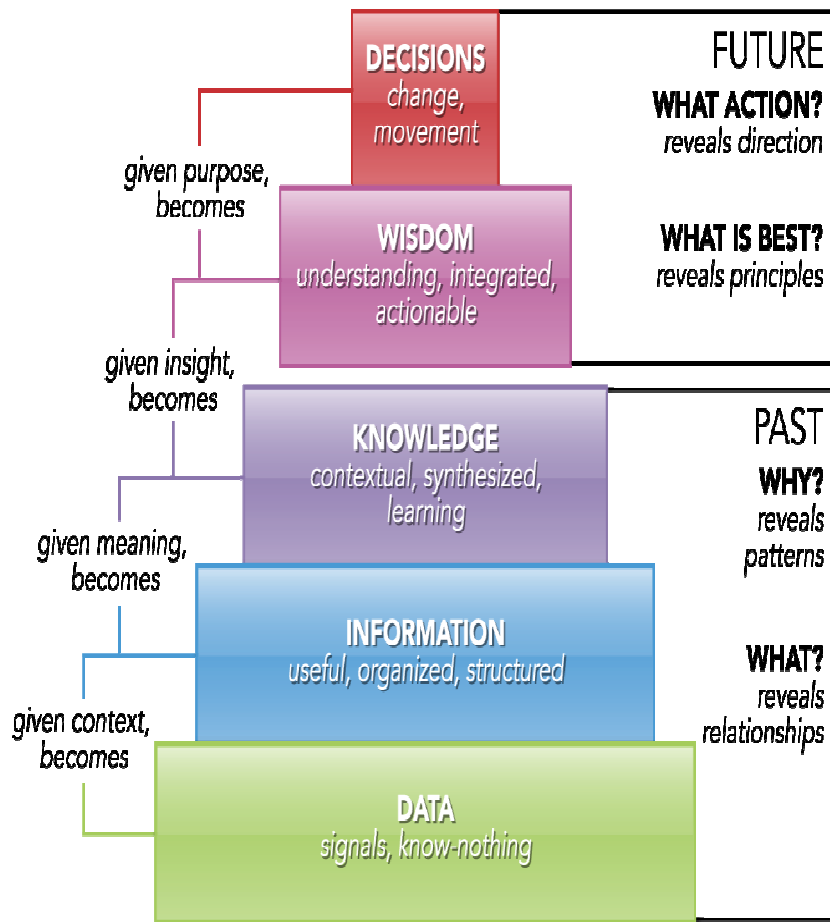
**Credit Risk Analysis (CRA)** is integral to every step in the credit lifecycle process, from prospect and customer segmentation, through origination scorecards, to the design and execution of account management and collection strategies, whether for mortgages, personal loans and lines of credit, credit cards, educational loans, auto loans, and other consumer finance vehicles.



**CRA** is about identifying and mitigating risk associated with financing credit product to customers. Risk team quantify risk, monitor and report risk of prospect or customer by development of risk monitoring tool, scorecard and models.

**CRA** guides us in taking decision on customer's associated risk for pricing as well credit exposure decision associated with it.

# Journey from DATA to DECISION



## In Credit Risk Analysis,

Team explore credit bureau data to understand and gather information about customers [*Exploratory Data Analysis*]

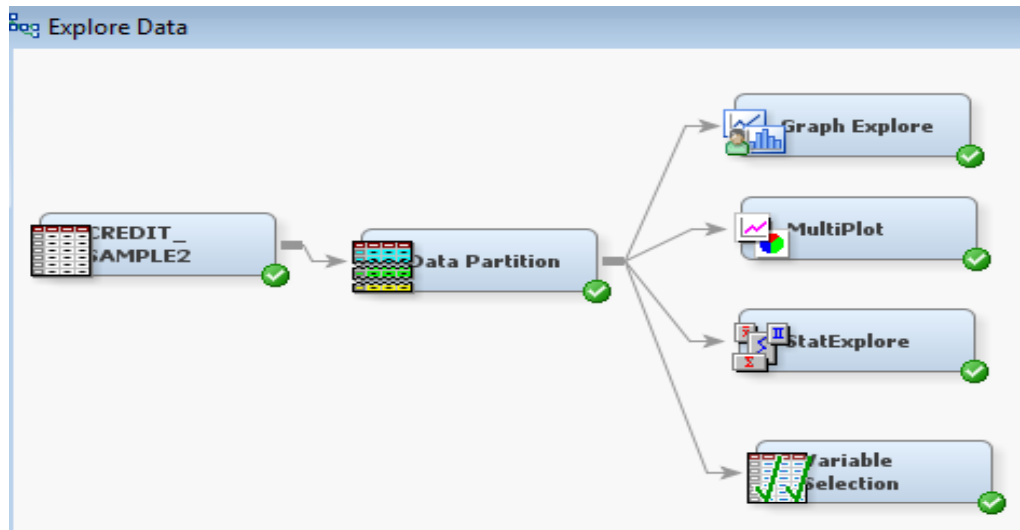
Analyze raw data to synthesize the knowledge and develop quantitative risk tools [*Develop Quantitative Tools*]

Validate best tool by comparing results in different time and scenarios. [*Validate & Compare*]

Integrate tool into strategy for credit decisions by evaluate best strategy [*Best Strategy Evaluation*]

Credit Industry heavily relies on analyzing standard credit scoring and customer provided information for credit decisions.

# Exploratory Data Analysis (EDA)



SAS® Enterprise Miner™ is the SAS solution for data mining. In EDA phase, risk team gathers information to get familiar with structure of data and identify initial drivers of risk. SAS® Enterprise Miner™ provides several data exploration nodes

✓ *Graph Explore node* : explore data graphically to uncover patterns and trends.

✓ *Stat-Explore node*: generates summary statistics and can examine variable distributions and statistics. It contributes to the initial analysis before getting deep into causation analysis.

✓ *Multi-Plot node*: explore data graphically to observe data distributions and to examine relationships among the variables [i.e. By Bar graph or scatter plot].

✓ *Variable Selection*: identifies initial input variables useful for predicting the target.

*Note: These nodes eliminate the need to write many lines of code in PC SAS to accomplish the same results.*

# Exploratory Data Analysis – contd..

## Sample Bureau Data\*

Obs #	AVG_MO...	TOTAL_...	TOTAL_...	PROFIT	DELINQU...	DELINQU...	DELINQU...	AMOUNT...	AGE	RESIDEN...	STATUS
1	18	444	1	9.88	0	0	0	0	34	Own Home ...	OK
2	25	285	2	7.7	1	0	0	0	.	.	OK
3	123	1471	3	32.42	0	0	0	0	25	Other	OK
4	31	85	6	7.7	2	1	0	0	46	.	OK
5	21	196	0	3.92	0	0	0	0	65	.	OK
6	943	828	111	-815.6	0	0	4	943.16	57	Rent	Bad Debt
7	887	1362	284	311.24	4	1	0	0	44	Own Home ...	OK
8	17	765	0	15.3	0	0	0	0	39	.	OK
9	357	5583	47	158.66	1	0	0	0	56	Rent	OK
10	557	519	38	-509.29	0	0	3	557.67	22	Rent	Bad Debt

Non Missing	Missing	Minimum	Median	Maximum	Skewness	Kurtosis
19979	435	17	36	98	0.892763	0.190791
20414	0	0	0	9837.6	9.362313	204.2283
20414	0	-552	37	9837	3.736806	34.90551
20414	0	0	500	30000	5.858513	162.8439
20414	0	0	344	867	0.774771	3.587086
20414	0	-8647.92	10.62	1760.16	-6.91071	144.0462
20414	0	1	500	10000	1.800707	13.72055
20414	0	1	415	60604	20.87795	1326.986
20414	0	0	1	1642	3.915707	30.50334
11485	8929	0	3	99	2.641392	10.42845

Let's analyze a sample bureau data with people demographics, payment history, length of credit, type of delinquency... etc where target\*\* is STATUS = 'OK' or 'Bad Debt'. We started exploring data by generating descriptive statistics, bar charts, scatter plots for variables as well as how target is related to other variables.

\* Data is for illustrative purposes only \*\* Target is term used for response variable.

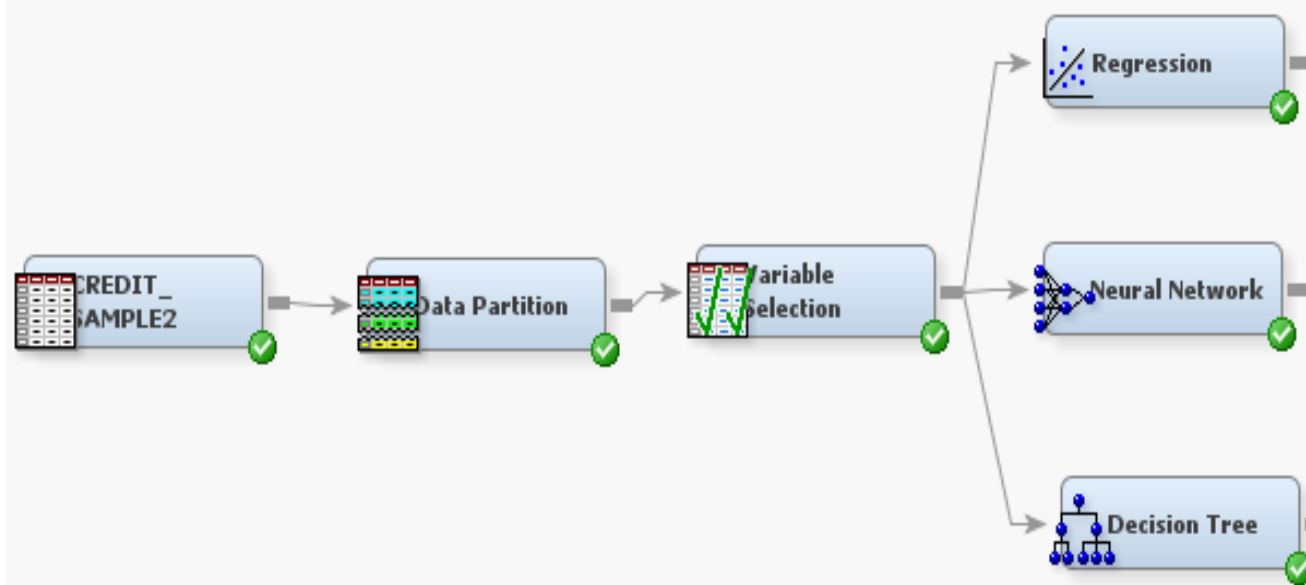
# Exploratory Data Analysis – contd..



In the exploration nodes of Enterprise Miner™, visualization tools are useful in graphically representing the distributions of target vs. other variables.

\* Data is for illustrative purposes only.

# Develop Quantitative Tools



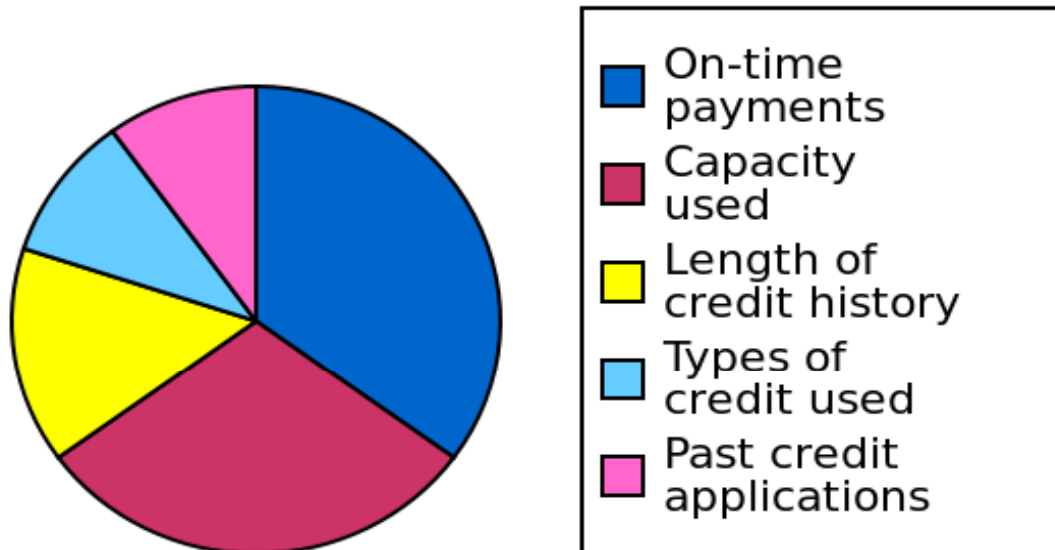
In developing quantitative tools, SAS® Enterprise Miner™ provides us numerous tools & techniques to identify top predictors .

- ✓ Selection of final variables can be done through different approaches [i.e. Variable Selection, CHAID Analysis or Regression selection procedure stepwise, forward or backward].
- ✓ Variable Clustering is useful in identifying variables from groups of highly correlated variables.
- ✓ In the Risk Industry, quantitative tools are used in developing predictive models or scorecard or strategies.



# Develop Quantitative Tools contd..

## **CREDIT SCORE FACTORS**

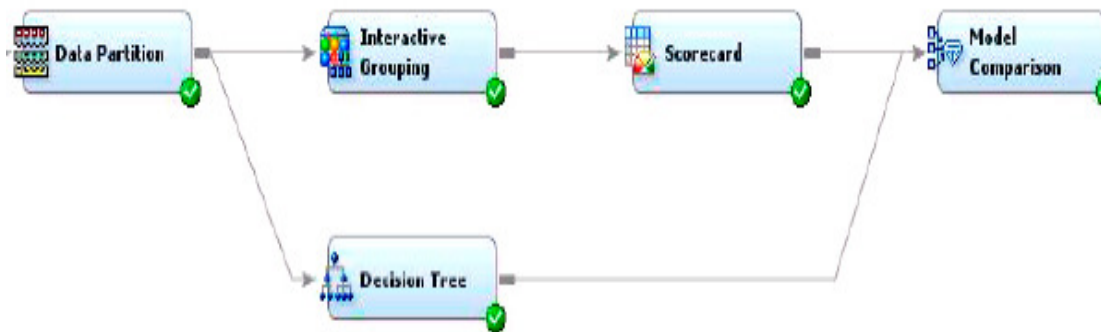


The traditional form of a credit scoring model is a scorecard.

In Credit Risk Analysis, scorecard plays a key role in decision making.

Team uses different types of credit information to calculate the FICO score for the general population.

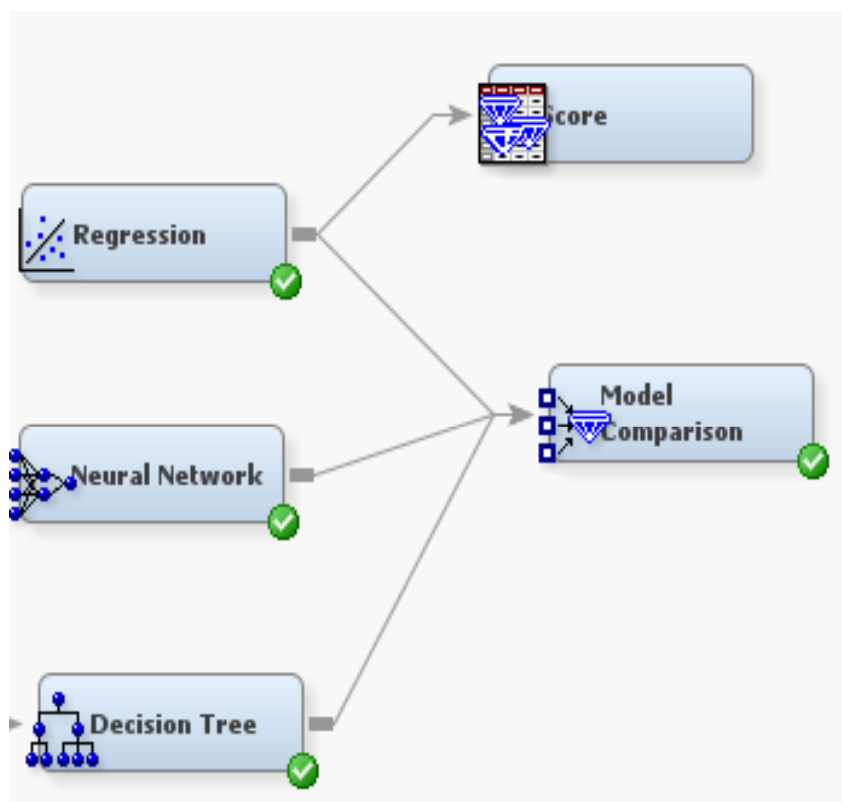
## Develop Quantitative Tools contd..



SAS® Enterprise Miner™ development of scorecard takes following steps

- ✓ Careful selection of best attributes with high information values
- ✓ Binning of variables and then grouping bins variables [*Interactive grouping node*]
- ✓ Modeling of approved credit accounts ('Accepts') [*Scorecard node*]
- ✓ Building scorecard on accepts as well as inference performance of "rejects" (*reject Inference node*).

# Validate & Compare

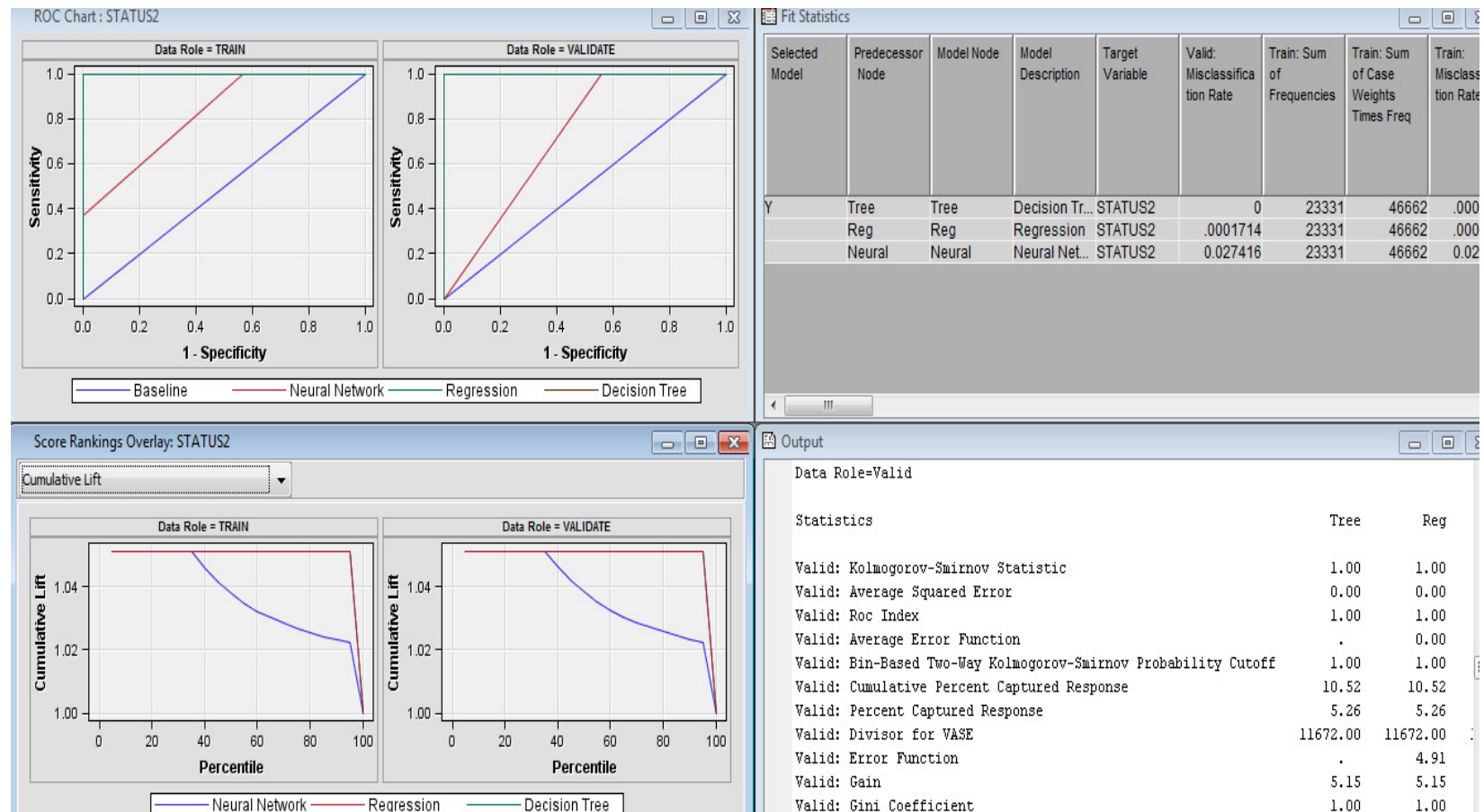


With SAS® Enterprise Miner™, it is possible to create, validate and compare a variety of model types such as regression, scorecards, decision trees or neural networks. When we evaluate which model type is best suited for achieving our goals, we consider criteria such as

- Parsimony (complexity)
- Integration efficiency
- Accuracy

The Score node functionality in Enterprise Miner™ facilitates scoring. It also generates SAS codes for outside validation.

# Validate & Compare contd..



Model Comparison output provides model statistics to compare and assist in decision making process.

# Best Strategy Evaluation



In the final step of Credit Risk Analysis:

- ✓ The Risk team compares and evaluates newly developed strategies/models with existing strategies.
- ✓ Validate strategies in different scenarios

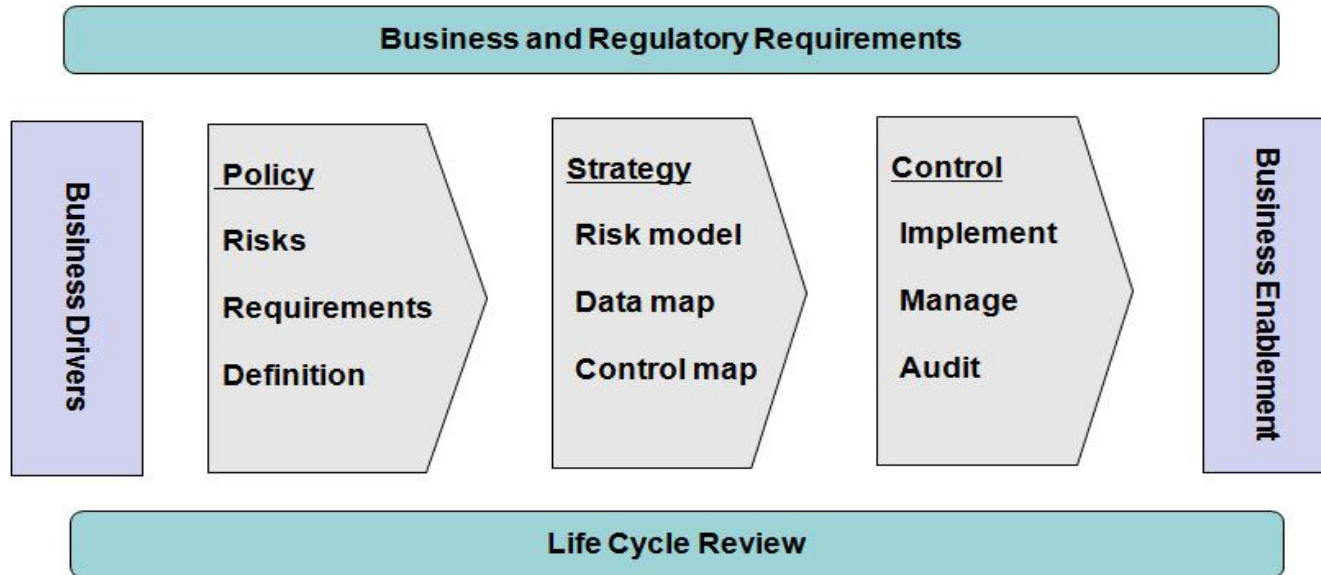
SAS<sup>®</sup> Enterprise Miner<sup>™</sup> offers number of benefits in best strategy evaluation

# SAS® Enterprise Miner™ – additional features

SAS® Enterprise Miner™ is the SAS solution for data mining.

- ✓ Easy handling of huge amount of data, no sampling required
- ✓ Several nodes for customization and exploration of raw data for faster data analysis
- ✓ Variety of model types such as scorecards, regression, decision trees or neural networks
- ✓ Testing new ideas and experimenting with new modeling approaches
- ✓ Specialize nodes to meet industry specific need and standard regulation
- ✓ Provides required documents and graphs for governance review
- ✓ Easy graphical representation of complex quantitative analysis for senior leaders
- ✓ Scoring code in many programming languages for easy and fast technology implementation

# Challenge of Credit Risk Industry



It's a dynamic and continually evolving industry; it's sensitive to macroeconomic environment, government regulation and risk appetite of companies. CRA plays a great role in monitoring and predicting future risk under regulatory environment.

# Questions?

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# Reference

Getting Started with SAS Enterprise Miner™7.1

<http://support.sas.com/documentation/cdl/en/emgsj/64144/PDF/default/emgsj.pdf>

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Data Mining Using SAS Enterprise Miner: A Case Study Approach, Second Edition by SAS Institute

Customer Segmentation and Clustering Using SAS Enterprise Miner, Second Edition by Randy S. Collica